



The VirtualwindoW



Participants

Idaho National Engineering and Environmental Laboratory
Bristlecone Technologies, Inc.
Directed Perception, Inc.

Technology Need

Technological advances over the past 10 years have significantly increased the capabilities of computers, electronics and automated machinery. Because of this rapid improvement, the technology of robotics has begun to play a key role in clean up and remote operations. A growing concern about the rapid advances in technology is that remote and robotic systems will become so complex that the complexity and number of controls will overwhelm operators. There is a distinct need to develop better man-machine interfaces.

Research Objective

The Idaho National Engineering and Environmental Laboratory (INEEL) has been researching methods to simplify the man-machine interface by applying telepresence techniques. (The term "telepresence" refers to techniques and/or technologies which can give an operator of remote or robotic equipment the sense of being present in a remote environment.) The overall goal is to develop an intuitive man-machine interface that minimizes the complexity of remote stereo viewing controls and provides the operator the "feel" of viewing the environment in a natural setting. The operator's hands would also be freed to remotely operate vehicles or manipulators rather than constantly repositioning cameras during the work.

Technology Description

A unique user interface has resulted from this telepresence research which INEEL developers call the "VirtualwindoW". The INEEL VirtualwindoW was developed to give the user the feel of looking out of a window and into the remote

environment. As an observer looks through a window, objects in the plane of view are held within the window boundary. If the observer desires to look beyond the window's edges, they simply shift or reorient their gaze. Similarly, as the user of this system desires to see beyond the bounds of the displayed view, they merely reorient their gaze toward the edge of the screen. The system notes the change in the operator's head position and responds by moving the cameras and changing the displayed image. All of this action becomes transparent to the operator and the resulting effect is more like peering through a window than looking at a display.



The VirtualwindoW has gone through several iterations during its development, but has maintained several key features:

- Multiple camera capability
- High resolution stereo (3-D) and mono vision
- Head-tracking camera positioning
- Voice-activated controls
- Large video monitor

In addition, the VirtualwindoW can also provide the following enhancements:

- Head-activated zoom and focus
- A unique single camera stereo zoom system
- Stereo sound from the remote environment

The VirtualwindoW can switch between multiple video signals, and between control of multiple pan and

tilt units or other camera positioning devices. All of the commands accessible to the user have been made available via a voice recognition system. For example, switching from one stereo camera to a second is accomplished simply by speaking the number of the desired camera. Additionally, all of the user executable commands can be implemented using keyboard input for maximum flexibility.

Research Opportunities

There are certainly opportunities to perform more research with the VirtualwindoW. Areas of possible future research include development of a system for use on submersible vehicles and development of a robust wireless system for field applications such as remote surveillance and remote vehicle operation.

Technology Status

In 1996 the original VirtualwindoW system was integrated onto a robotic dismantlement system, the Dual Arm Work Platform (DAWP). From February 1997 to September 1998 the system has functioned quite reliably on a daily basis as the DAWP was used to dismantle an old nuclear reactor in Illinois (see the DAWP white paper for details).

After nearly four years of research and field use, the VirtualwindoW technology is quite mature and ready to be licensed. A patent is being pursued on the original work and an enhancement to the original patent application has been submitted.

Contact

Matthew O. Anderson
Idaho National Engineering and Environmental Laboratory
P.O. Box 1625
Idaho Falls, ID 83415-2220
Telephone: (208)526-4308
Fax: (208)526-7688
E-Mail: matthew@inel.gov